Point vs. Nonpoint Source Pollution

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Overview

Students will create a watershed model and use it to identify and distinguish between point sources and non-point sources of pollution.

Learning Objective(s)

In this lesson, students will:

1. Distinguish between point source and nonpoint source pollution
2. Describe at least five sources of nonpoint source pollution runoff
3. Identify at least three contaminants likely to be found in urban runoff and discuss possible sources of these contaminants
4. Be able to describe and discuss at least five actions that can be taken to reduce or eliminate contaminated runoff

Louisiana Content Standards/ GLEs

Grade	GLE	Science
5		**Science and the Environment**
	49	Identify and give examples of pollutants found in water, air, and soil (SE-M-A3)
	50	Describe the consequences of several types of human activities on local ecosystems (e.g., polluting streams, regulating hunting, introducing nonnative species) (SE-M-A4)
8		**Science and the Environment**
	50	Illustrate possible point and non-point source contributions to pollution and natural or human-induced pathways of a pollutant in an ecosystem (SE-M-A3)
	51	Analyze the consequences of human activities on global Earth systems (SE-M-A4)
9-12		**Environmental Science**
		Ecological Systems and Interactions
	12	Give examples and describe the effect of pollutants on selected populations (SE-H-A11)
		Environmental Awareness and Protection
	20	Relate environmental quality to quality of life (SE-H-C2)
		Personal Choices and Responsible Actions
	24	Identify the advantages and disadvantages of using disposable items versus reusable items (SE-H-D1)
	25	Discuss how education and collaboration can affect the prevention and control of a selected pollutant (SE-H-D2) (SE-H-D3)
	26	Determine local actions that can affect the global environment (SE-H-D4)

Grade Level
5-12

Duration
1 class period

Subject Area
Science

Setting
Classroom

Vocabulary
Point pollution
Non-point pollution
Watershed

Adapted from:
*University of Nebraska Lincoln Extension, "*A Crumpled Watershed Model"

Materials List

- One piece of easel paper per student group, or individual sheets of printer paper
- One copy of watershed illustration per student (optional)
- Pencil
- Water-based markers
- Spray bottles with water
- BLM – Swimmin' in Guacamole

Background Information

Pollution that enters our water resources are grouped into two categories, point source pollution and non-point source pollution. These categories contain many types and sources of pollutants and are based on the method in which the pollution enters or is released into a water source.

Point source pollution comes from a specific place that can be pinpointed as the source of the pollution contaminating a water body. One example is an industrial site with a pipe directly dumping untreated or improperly treated pollutants into a water source. Another point source would be a wastewater treatment plant that cannot handle all the incoming wastewater and discharges raw sewage into a local stream or river. Point source pollutants are most often minerals, chemicals, and sewage.

Non point source (NPS) pollution is the pollution of water resources from a wide variety of human activities that take place over a large geographic area. NPS pollution comes from farms, cities, forests, mining operations, construction sites, and our homes. It occurs when runoff from rain and snowmelt picks up pollutants left or dumped on the ground and carries them into our streams, rivers, lakes, and groundwater. These pollutants include sediments (soil), fertilizers, and nutrients, oils and grease, pesticides, toxic chemicals, road salts, domestic animal waste, untreated sewage from homes not hook-up to a city or community wastewater treatment plant, and other contaminants. The most common NPS pollutants are sediments, nutrients, and sewage.

Procedure/Engagement

Preparation

1. Explain to students that their sheet of paper represents a large area of land. Have students use their pencils to draw a community with a neighborhood of homes, a factory, farms, chemical plant, shopping centers and roadways to connect them all.
2. When students are finished with their drawings they should then use the black markers to outline the roadway, green for the lawns around the homes and farm, brown for the fields of the farm, red for a pipe coming out of the factory and blue for a pipe coming out of the chemical plant.
   Optional: Students can color the watershed model BLM if time is short.
3. The last thing our land needs is some topography. Have students take their sheet of paper and crumple it up in their hands. It is better to have a loose wad than a tight ball.
4. Have students open up the paper, but not flatten it. You want it to have some "relief" - some high and low places. The high places are hills, the low spots are valleys and the wrinkles are streams and rivers. The students have now created a model of a watershed.
5. Go through each color and discuss with students some common pollutants that are associated with neighborhoods, farms, etc. Students should identify at least five sources.

Engagement

1. Using the spray bottle, have students make it rain in the watershed. They are to squirt a fine mist over the watershed model, enough to make water flow down the "hills".
2. Observe carefully. They will now see the colors running into the streams along with the water. That's what happens when things on the ground are picked up by stormwater runoff - they end up in streams and rivers, moving down the watershed.

3. What are some differences in the pollution that is coming from the neighborhoods, streets and the farm compared to the pollution coming from the factory and chemical plant? Direct students to notice that pollution from some areas appear to be widespread while other pollution can be pinpointed to a particular source.
4. This difference, an exact source vs. widespread source, is the definition for point source vs. non-point source pollution. Students should identify the lawns, roadways and farms as being contributors to nonpoint source pollution since the pollution is widespread and not identifiable to a particular source. The pollution coming from the factory and chemical plant should be seen as point source pollution since it can be traced back to a single source.

Explore/ Explain

1. What type of pollution do students think is easier to identify and control? Why?
2. What are some challenges with controlling nonpoint source pollution?
3. Have students read and answer the questions in the BLM, "Swimmin' in Guacamole."

Conclusion

Have students work together to develop actions they can take that will reduce or eliminate sources of nonpoint source pollution. Discuss these actions as a class.

Assessment

Assessment might include the development of a formal action plan, given a specific scenario. Also include questions related to point and nonpoint source pollution on quizzes and tests.

Extended Activity

Participate in a storm drain marking program to educate the public about the effects of polluted runoff on our waterways. Visit http://nonpoint.deq.louisiana.gov/wqa/education.html for a form for storm drain markers.

Resources

Polluted Runoff: Nonpoint Source Pollution
https://www.epa.gov/polluted-runoff-nonpoint-source-pollution

Categories of Pollution: Point Source
http://oceanservice.noaa.gov/education/kits/pollution/03pointsource.html

Swimmin' in Guacamole

Lake Okeechobee is a large inland lake in southern Florida. Heavy rains in 2016 resulted in the lake reaching the highest water levels in nearly a century. The Army Corps of Engineers, the federal agency in charge of monitoring water levels made the decision to release the excess water from the lake in order to prevent the chance of flooding the homes of the thousands of people that live around the lake. There is only one problem: the waters of Lake Okeechobee are extremely polluted.

Much of the pollution comes from agricultural runoff from the many farms that surround the lake. Along with various chemicals, this runoff contains manure and fertilizers full of nutrients that certain species of bacteria love to eat. As bacteria consume these nutrients they multiply rapidly, resulting in what is called an "algae bloom."

The excess waters from Lake Okeechobee have caused massive blooms of toxic algae as they have spilled into the rivers and estuaries that connect to the coast. Discharges from sewer systems into these rivers have compounded the problem. The algae blooms have become so bad that they have reached the beaches, devastating the local tourism industry in the affected counties. The algae is said to be the consistency of guacamole, but with the smell of rotting food. A state of emergency has been declared in four counties that have been hardest hit by the algae.

There are various proposals to address this issue. Some citizens feel the dikes that control the lake should be reinforced so that the water doesn't need to be released. Others want the state to purchase land to the south of the lake and use it as a natural buffer and area for water storage. Still others want the state to force farms and cities to reduce the amount of pollution they release.

1. Identify the sources of pollution in the passage above.

2. Are the sources you identified point source or nonpoint source? Justify your response.

3. What is the challenge in forcing farms and cities to reduce the amount of pollution they release?

4. What solution would your propose?

Sources for the information in this passage include:
The Washington Post - https://www.washingtonpost.com/news/morning-mix/wp/2016/07/01/floridians-outraged-over-smelly-guacamole-thick-toxic-algae-invading-coastline/
Phys.org - http://phys.org/news/2016-07-florida-algae-problem-stems-decades.html
The Miami Herald - http://www.miamiherald.com/news/local/environment/article86989367.html